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Patent Application of

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for

COLLAPSIBLE BABY STROLLER AND RELEASABLE LOCKING AND FOLDING MECHANISM THEREFOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to wheeled infant carriages or designed to carry an infant smoothly and safely while walking, jogging or traversing uneven, rough, or unpaved terrain. And more particularly to a design conveniently portable and collapsible.

2. Description of The Prior Art

Traditionally, baby strollers have been used to push an infant slowly on a relatively hard, smooth floor or paved surface. As a result, the strollers were made with short wheeled bases and small wheels. These strollers work well at slow speed, but are extremely unwieldy and even dangerous on rough surfaces or at higher speeds.

As parents have become more health conscious, jogging and fast walking have become popular pastimes. Because baby strollers were not designed to be operated at high speed or on rough terrain, it was infeasible for a parent to jog or walk fast using a traditional baby stroller. Even for non-jogging parents, the need for an improved baby stroller has been apparent. The small,

plastic wheels and short wheel bases customarily used for the baby strollers are almost useless when it is desired to walk with an infant in a grassy park or on a rough road or sidewalk. Parents end up not walking with the infant at all or only walking in limited areas.

Recently, all-terrain baby strollers have been designed to overcome these problems. These strollers typically employ much larger wheels and longer wheel bases. The stroller frame and frame connections are constructed to be stronger and larger to handle the heavy-duty use they may receive. These all-terrain strollers have their drawbacks. The increased size has made them difficult to store and transport and the folding/collapsing mechanisms are time consuming and cumbersome. For this reason, the present invention provides a quick and easy method of collapsing the stroller for storage or transport.

3. Objects and Advantages

Collapsible strollers are not a new concept. The collapsing process for most strollers, however, typically requires the use of both hands, often requires the application of large forces, and may be dangerous due to scissoring of truss-like members of the stroller structure. Most collapsing mechanisms are not intuitive to the user and require a lesson from a sales person or studying of instructions. Often, the parent is holding packages or the infant in one arm and has only one hand free to collapse and stow the stroller. The present invention provides an intuitive folding mechanism, requiring only one hand to collapse or unfold the stroller. Safeguards assure that the stroller collapses only when desired by the parent. Further, there are no pinch points or scissoring members in the folding mechanism.

When jogging with a conventional all-terrain stroller, the axle connecting the two rear tires often impedes the stride of the jogger (especially joggers with long strides). In the present invention, the rear wheels are cantilevered, giving the jogger clearance for a long stride.

Other novel features of the design are the use of an over-center mechanism to deploy a sun canopy on the stroller and another over-center mechanism to engage a foot-activated parking brake.

SUMMARY OF THE INVENTION

The present invention is an all terrain/jogging, portable, collapsible baby stroller. The stroller frame consists of three cantilevered, tubular sections, which are hinged and constrained to move together by a means for such purpose. The three cantilevered sections are the front fork, which holds the front tire, the handle bar, and the rear support, on which the rear tires are mounted.

The means for hinging and constraining the motion of the cantilevered sections consists of a mechanism on either side of the stroller. Each mechanism consists of two meshing partial gears and a spring-loaded piston, which moves in line with the rear support. Secured to the side of each gear is a knife blade follower, which comes in contact with the piston in the locked and unfolded position. One gear is fixed to the front fork while the other is fixed to the handle bar. In the locked and unfolded position, the rotation of the gears with respect to one another is constrained by a flat in one direction and the knife blade followers against the extended spring loaded piston in the other direction. The cantilevered sections are constrained at fixed angles to one another. In this embodiment, the front fork forms approximately a 90-degree angle with the rear support and approximately a 180-degree angle with the handle bar. The rear support bisects the angle between the handle bar and the front fork.

To collapse the stroller, the stroller is lifted by a strap which is connected on either end to a lever, which depresses the spring-loaded piston on each side of the stroller. With the depression of the spring-loaded piston, the rotation of the gears relative to one another is no longer constrained. Continuing to hold the strap causes the stroller to collapse under its own weight; all of the cantilevered sections rotate into positions approximately parallel to one another.

The front fork consists of two separate pieces of tubing. At one end, each piece is fixed to the folding mechanism. At the opposite end a notch is cut in each tubular piece to accommodate the axle of the front tire. The notch allows the user to quickly remove the front tire.

The handle bar is made from a single piece of tubing or bar stock bent through 180 degrees so that the ends of the piece are parallel to one another. Each end is fixed to one of the two folding

mechanisms. The bent portion of the tubing is typically from where the stroller will be pushed. Therefore, it is coated with foam for comfort.

The present embodiment of the invention contains a retractable canopy to shelter the infant from the elements. The canopy is made from a piece of fabric. The front edge of the fabric is secured to a batten or bent rod, which gives the canopy its shape. The rear edge is secured to the handle bar. The forward batten is connected to the handle bar through two over-center mechanisms. These over-center mechanisms allow the canopy to be fully deployed or fully retracted, in a firm and stable manner.

Each over center mechanism consists of a casing, a spring-loaded rod and a rotating piece. The spring-loaded rod is constrained as a slider joint by the casing and as a pin joint by the rotating piece. The casing is fixed to the handle bar and the rotating piece is fixed to the batten. The rotational freedom of the rotating piece is constrained by a groove in the casing. Because of the motion constraints on the rotating piece, the canopy will become fully deployed if the canopy is moved more than half way to the deployed position or fully retracted if the rotating piece is moved less than half way to the deployed position.

The rear wheels are mounted to the rear support via a hub assembly for such purpose. Each rear wheel axle ~~is~~ fits into a hole in a hub assembly case, which is injection molded plastic. The axle is notched and held in place by a spring-loaded pin, which fits in the notch. The spring-loaded pin acts as a quick-release mechanism. When the pin is pulled, the axle can easily be removed from the hub assembly. To replace the wheel, the axle is inserted into the hub assembly and snaps into place, as the spring-loaded pin seats in the groove in the axle.

The hub assembly also houses a foot brake. The foot brake employs an over-center mechanism similar to the one used for the canopy deployment. The foot brake lever, typically made from stamped steel, is pinned to the hub assembly casing. When the lever is rotated, a finger, which is part of the lever, engages with a toothed disk, which is fixed to the wheel. The rotating motion of the lever is affected by an over-center mechanism. The over-center mechanism consists of a spring-loaded rod, pinned to the lever on one end and fixed as a slider by the hub assembly casing on the other end. When the lever is between the fully-engaged and the fully-

disengaged positions, the over-center mechanism tends to move the lever to either position. Another important feature to the design of this foot brake is the use of plastic or metal balls on the rod, between which the spring seats. The balls prevent the spring from binding on the hub assembly casing or the lever and allow low friction movement.

BRIEF DESCRIPTION OF THE DRAWINGS

The above features, advantages, and object of the present invention will more fully be appreciated through consideration of the following drawings in which:

FIG 1 shows an isometric view of the present invention, a collapsible all-terrain stroller.

FIG 2 shows an exploded view of the folding mechanism, which allows the user to easily fold and unfold the stroller.

FIG 3 shows orthogonal views depicting the functionality of the folding mechanism.

FIG 4 shows an exploded view of the canopy deployment mechanism.

FIG 5 depicts the functionality of the canopy deployment mechanism.

FIG 6 shows an orthogonal view of the hub assembly.

FIG 7 shows isometric and orthogonal views of the folding procedure.

REFERENCE NUMERALS IN DRAWINGS

- **2** Front Fork
- **3** Rear Support
- **4** Handle Bar
- **10** Folding Mechanism
  - **11** Outer Half of Folding Mechanism Case
  - **12** Inner Half of Folding Mechanism Case
  - **13** Forward Partial Gear
  - **14** Rear Partial Gear
  - **15** Knife Blade Follower on Forward Partial Gear
  - **16** Knife Blade Follower on Rear Partial Gear
  - **17** Spring Loaded Piston
  - **18** Release Lever
  - **19** Fulcrum Plate
  - **20** Fulcrum Pin
  - **21** Gear Hubs
  - **22** Spring for Piston
- **30** Front Wheel
- **32** Foot Rest
- **34** Release Strap
- **36** Infant Seat
- **40** Hub Assembly

- **41** Hub Assembly Case
- **42** Quick Release Pin
- **43** Quick Release Spring
- **44** Brake Lever
- **45** Brake Lever Fulcrum
- **46** Over-center Mechanism Rod
- **47** Over-center Mechanism Spring
- **48** Nylon Balls
- **49** Toothed Disk
- **50** Assembly Bolts
- **51** Rear Axle

60 Mechanism for retracting Canopy

- **61** Over-center Mechanism Rod
- **62** Canopy Deployment Mechanism Casing
- **63** Rotating Piece
- **64** Forward Canopy Batten
- **65** Over-center Mechanism Spring
- **66** Fastener from Casing to Handle Bar
- **67** Fastener from Casing to Handle Bar, mating with groove in rotating piece
- **68** Fastener about which rotating piece rotates
- **69** Canopy

DETAILED DESCRIPTION OF THE INVENTION

1. *Overall Stroller Configuration*

Referring now to the drawings, particularly **FIG 1**, there is shown a three-wheeled all terrain collapsible infant stroller. Three rigid assemblies **2-4**, which are connected to one another via two folding mechanisms **10**, form the fundamental structure of the stroller.

The front fork **2** consists of two pieces of tubing **2a-2b**. One end of each front fork section **2a-2b** is notched in order to accommodate the axle of the front wheel **30**, allowing for easy disassembly. The other end of each front fork half **2a-2b** is attached to a folding mechanism **10**. A footrest **32** is secured to both halves **2a-2b** of the front fork **2** above the front wheel **30**.

The rear support **3** consists of two rear legs **3a-3b** and a cross brace **3c**, which are made from tubing. For each leg **3a-3b**, one end is secured to a folding mechanism **10** and the other secured to a hub assembly **40**. The cross brace **3c** is secured to both rear legs **3a-3b**, sufficiently close to the folding mechanism **10** to provide clearance for long strides.

The handle bar **4** is made from a single piece of tubing or bar stock, bent through 180 degrees. Each end of the handle bar **4** is secured to one of the two folding

mechanisms **10**. A retractable canopy **60** is attached to the handle bar **4** in order to protect the infant from the elements.

2. *Releasable Locking and Folding Mechanism*

A key feature of the present invention is a novel folding mechanism **10**. An exploded view of the folding mechanism **10** is shown in **FIG. 2** and a functionality view is shown in **FIG. 3**. The folding mechanisms **10** control the angles between the front fork **2**, the rear support **3**, and the handle bar **4**, and thus enables the user to collapse or unfold the stroller with ease. Within the folding mechanism are two meshing partial gears **13-14**, made of stamped steel in the preferred embodiment of the present invention. The gears **13-14** rotate about gear hubs **21**, which are fixed to the folding mechanism case, consisting of a outer **11** and inner **12** half. Partial gear **13** has an appendage which is fastened to the handle bar **4** and partial gear **14** has an appendage which is fastened to the front fork **2**. The case **11-12** is secured to the rear support **3**. The meshing of the gears **13-14** constrains the relative angle between the handle bar **4** and the front fork **2**, so that when the handle bar **4** is rotated toward the rear support **3**, the front fork **2** rotates toward the rear support **3** and vice versa. This is a key feature in the design because it enables the stroller to be unfolded by merely lifting on the handle bar **4**. Gravity rotates the handle bar **4** away from the rear support **3**, and the front fork **2** swings out into position.

It is desired to keep the stroller in a locked and open position until the user wishes to fold it up for storage or transport. The folding mechanism **10** contains features to accomplish this. Each gear **13-14** has a knife blade follower **15-16**, made from stamped steel in the preferred embodiment, fastened to it. Knife blade follower **15** is fixed to the inner side of partial gear **13** and knife blade follower **16** is fixed to the outer side partial gear **14** so that the followers **15-16** do not interfere with one another when the stroller is collapsed. When the stroller unfolds into a fully open position, a piston **17**, is pushed down by the knife blade followers **15-16** against a loaded spring **22** until the followers **15-16** reach the fully open position and the piston **17** is forced between the followers **15-16** by the spring **22**. Thus the rotation of the handle bar **4** and front fork **2** relative to the rear support **3** is constrained by a lack of gear teeth in one direction and the knife blade followers **15-16** against the spring-loaded piston **17** in the other direction.

A key feature of the folding mechanism **10** is that the piston **17** and followers **15-16** are engaging in a wedging manner due to the angled piston **17** - follower **15-16** engagement surfaces. This wedged piston **17** has sufficient travel to accommodate manufacturing tolerances and wear accumulations by continuing to wedge the followers apart until the mechanism **10** is firmly locked open. The piston spring **22** is adequately sized to always drive the piston **17** into its highest possible position, maximizing the rigidity of the entire frame structure.

It is also desired to be able to easily collapse the stroller for storage or transport. The stroller is unable to collapse until the spring-loaded piston **17** is retracted so that the gears **13-14** are free to rotate relative to the case **11-12**. In order to retract the spring-loaded piston **17**, a release lever **18** rocks about fulcrum pin **20**, which is held in place by fulcrum plate **19**. The fulcrum plate **19** is fastened to the inner half **12** of the case so that when a force is applied to the long arm of the release lever **18**, a force which tends to retract the spring-loaded piston **17** is generated.

In the preferred embodiment of the invention, a release strap **34** is connected to the release lever **18** on both folding mechanisms **10**. The release strap **34** lays in the seat **36** so that when the infant is removed from the stroller, the parent can lift on the release strap **34**, which retracts the spring-loaded pistons **17**, allowing the handle bar **4** and front fork **2** to rotate toward the rear support **3**. Because the center of gravity of the handle bar **4** is typically above the folding mechanism **10**, the stroller tends to collapse under its own weight when the release strap **34**, is pulled, thus requiring only one free hand to collapse the stroller. Similarly, when unfolding the stroller, lifting the handle bar **4** tends to unfold the stroller. When the stroller fully open, the spring-loaded piston **17**, moves between the knife blade followers **15-16**, locking the stroller in its operational position.

3. *Canopy Deployment Mechanism*

The mechanism **60** for deploying and retracting a canopy **69** is a novel feature of the present invention. An exploded view of this mechanism is shown in **FIG. 4** and a functionality view is shown in **FIG. 5**. This mechanism consists primarily of a spring-loaded rod **61**, a mechanism casing **62**, and a rotating piece **63**. The casing **62**, made from injection molded plastic in the preferred embodiment, is fixed to the handle bar **4** with fasteners **66-67**. The rotating piece **63**,

made from injection molded plastic in the preferred embodiment, rotates about fastener **68**, which mates with the casing **62**. Spring **65** fits around rod **61**. The spring-loaded rod **61** has a slider joint with the casing **62** and a pin joint with the rotating piece **63**. Batten **64** is constrained to move with the rotating piece **63** via an interference fit between the two pieces. As the rotating piece **63** rotates, the spring **65** becomes compressed. The compressed spring **65** tends to force the canopy **69** to its open position or to its deployed position depending on whether it has moved more than half way through its range of motion. The motion of the rotating piece **63** is further constrained in its rotation by fastener **67** being seated in groove **63a** of the rotating piece **63**.

4. *Hub Assembly*

The hub assembly **40**, shown in **FIG. 6** serves the following functions:

1) Provide a hub for the rear wheel axles.
2) Provide a quick release for the rear wheels.
3) Provide a rear wheel parking brake, deployable with an easy foot motion.

There are two hub assemblies **40** in the preferred embodiment; one fastened to the end of each of the rear legs **3a-3b**. Each rear wheel **31** has its own axle **51**. The axle **51** fits into the injection-molded hub assembly case **41** held together with assembly bolts **50**, which are housed by the case **41** as well. A notch **52** is machined in the axle **51** in order to mate with a spring-loaded quick release pin **42**. The quick release pin **41** prevents the axle **51** from separating from the hub assembly **40**. If the user desires to remove a rear wheel **31**, the quick release pin **41** is pulled away from the axle **51** and the wheel is easily removed. The spring **43** pulls the release pin **41** back so that when the axle **51** is reinserted into the hub assembly **40**, it snaps securely into place.

In order to prevent the stroller from rolling when parked, a foot activated parking brake feature is designed into the hub assembly **40**. A brake lever **44**, made from stamped steel in the preferred embodiment, has its fulcrum **45** fixed to the hub assembly case **41**. The brake lever **44** has a bulbous end **44a**,in the preferred embodiment, to facilitate easy deployment or release of

the brake with a simple foot motion. When the brake lever **44** is rotated down, an appendage **44b** on the brake lever **44** engages with a toothed disk **49**, which is fixed to the rear wheel **31**. It is undesirable to have the brake inadvertently deploy or release. For this reason, an over-center mechanism is included in the preferred embodiment. A spring-loaded rod **46** is pinned to the brake lever **44** and has a slider joint with the hub assembly case **41**. The spring-loaded rod **46** is designed so that the brake lever **44** is most stabile in either the fully deployed or fully retracted positions and only a deliberate foot motion from the user will change the foot brake position. In the preferred embodiment, plastic or metal balls are placed on the rod **46** on both sides of the spring **47** in order to prevent the spring **47** from binding on the brake lever **44** or hub assembly case **41**.

5. *Folding Sequence*

The folding sequence is outlined here and depicted in **FIG. 7**:

1) Depress foot brake levers **44** on both rear wheels **31** and retract canopy **60**.
2) Remove infant from seat **36**.
3) Grab hold of the release strap **34**, which is situated in the seat **36**, and lift on the strap **34** and continue to hold it. The release strap **34** will pull on both of the release levers **18**, which retract the spring-loaded pistons **17**. The handle bar **4**, because its center of gravity is above the folding mechanism **10**, will tend to rotate toward the rear support **3**, and because it is geared to the front fork **2**, the front fork **2** will rotate toward the rear support **3** as well.
4) The three rigid assemblies **2-4** will be parallel with one another and the stroller is ready for transport or storage. If it is desired to reduce the size of the stroller even more, the quick release pins **42** can be pulled to remove the rear wheels **31** and the front wheel **30** can also be removed